Digital Arts and Humanities Workshop Series – Spring 2018

Fridays @ noon -- Scholars Commons IQ-Wall

Date	Topic	Presenter
Jan. 12	Intro to Digital Humanities	Tassie Gniady
Jan. 19	Intro to Visualization	Michael Boyles
Jan. 26	Intro to R	Tassie Gniady
Feb. 2	Augmented Reality	Chauncey Frend
Feb. 9	Text Analysis of Kurt Vonnegut w/ the HathiTrust & Voyant	Tassie Gniady & Robert McDonald
Feb. 16	Virtual Reality	Bill Sherman
Feb. 23	R for Twitter	Tassie Gniady
Mar. 2	Advanced Media	Chris Eller
Mar. 23	Network Graphs	David Kloster
Mar. 30	3D Object Acquisition & Printing	Jeff Rogers
Apr. 6	3D Photogrammetry	Tassie Gniady
Apr. 13	IQ-Table & Touch-Enabled Software Workflows	David Reagan
Apr. 20	Omeka S and 3D Collections	Tassie Gniady & Will Cowan

Introduction to Visualization & the UITS Advanced Visualization Lab

(for the digital arts & humanities at Indiana University)

Michael Boyles
Manager, Advanced Visualization Lab
Indiana University

January 19, 2018

About Today's Workshop

Goals

- Learn about visualization services here at IU
- UITS Advanced Visualization Lab (AVL)
  - What is it?
  - Who works there?
  - What do they do?
  - How can it help me?
- Spur curiosity, ideas, and interest

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Outline

- Overview of AVL
- Creating experiences
  - Types of data
  - Relevant support areas
  - Deployments here at IU
- Examples
  - Available workflows & technologies
  - Real use cases from the IU community
- Discussion & meet-and-greet

UITS Advanced Visualization Lab

- Born in 1997, the AVL is 20 years young
- 8.5 full-time staff at IUB and IUPUI
- Research GA's and hourly interns

- Enable and empower the IU community (faculty, staff, students)
- Research, teaching, creative activity, community engagement

- Free access to visualization systems and training
- Free access to established and tested content creation and visualization workflows
  - Delivered via videos, documents, external URLs, infoshares, workshops, in-person meetings

- Available for short or extended consultations or prototyping
- Long-term buy-out for funded projects

Let’s create/enable ***experiences***!

Data visualizations
Interactive collaboration
Immersive simulations
Engaging & fun environments
Real-world data capture
Web-based viewing
Multi-touch exhibits
Stereoscopic 3D videos

assets + interface + display = experience

assets + interface + display = experience

Common Types of Data

- 2D media (images, videos)
- Text
- Audio
- Geospatial and geo-referenced
- “Informational” data (temporal, hierarchical, categorical, network, aggregated stats, etc.)
- Metadata
- 3D models
- Advanced media (S3D & 360)

** dedicated workshops*

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Existing Support Areas

- ✓ Virtual reality *
- ✓ Augmented reality *
- ✓ IQ-Tables & multi-touch exhibits *
- ✓ Information visualization
- ✓ Ultra-resolution visualization & collaboration using IQ-Walls
- ✓ Real-world object digitization & 3D printing *
- ✓ Advanced media capture *

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Deployments at IU

- ➢ Accessible public locations (lobbies, library, classrooms)
  - ➢ IQ-Walls
  - ➢ Reality Labs
- ➢ Black box innovation labs (specialized locations)
- ➢ Workflows and portable hardware to enable content creation

Virtual Reality & Virtual Environments

Hardware

- Large-format displays (IQ-Wall)
  - High resolution, inherently collaborative
- Head-mounted displays (Vive, Rift)
  - Excellent balance of cost-to-quality, reasonably portable
- Mobile displays (Gear VR, VR One)
  - Limited capability, outreach

- PIPES
  - Add environmental feedback devices

- Reality Labs

Software

- Unity
  - Modern 3D engine with high performance & quality rendering
  - Visual programming & GUI for non-technical users
  - Commercial software free for education
- X3D & WebGL technologies
  - Open-standard ensures longevity
  - Natively web-enabled

Reality Labs at IU as of 1/19/18

Location	*Type of space*	*# of Stations*	*Campus*
School of Art, Architecture + Design – 2017	Classroom	1	IUB
Media School – 2017	Classroom	10	IUB
School of Art, Architecture + Design – 2017	Classroom	10	IUB
UITS Advanced Visualization Lab – 2017	Lab	2	IUB
UITS Advanced Visualization Lab – 2017	Lab	8	IUPUI
UITS 3D Print & Modeling Lab – 2017	Lab	6	IUB
School of Informatics & Computing – coming 2018	Classroom	14	IUPUI
School of Art, Architecture + Design – coming 2018	Lab	2	IUB
UITS Idea Garden – coming 2018	Lab	2	IUPUI
Additional classrooms & labs – 2018	Classroom & Labs	TBD	IUB, IUPUI, regional campuses

Use Case: “Lux et Veritas” (LEV) Prototype & Walkthrough

- Virtual mock-up of a proposed renovation at IUPUI
- Modeled using SketchUp (chosen due to popularity)
- Unity for lightmaps and rendering (emphasis on visual quality and accuracy)
- Works on all VR devices (mobile displays -> head-mounted displays -> large-format displays)

Use Case: Piazza d'Oro: a 4D Tour (using PIPES)

- Data provided by Bernie Frischer, Prof. of Informatics
- Short (< 5 min) virtual tour through reconstructed Piazza d'Oro
  - Traverse from plaza corridor to far end dining hall
- Enhanced with heat and wind (when passing through openings) and smell (during final dining hall scene)
- Best Research Demo award at IEEE VR 2016

Examples: Virtual Reality

- PIPES – https://showcase.avl.iu.edu/avl-showcase/frontend/projects/5a3810a559d30

Augmented Reality

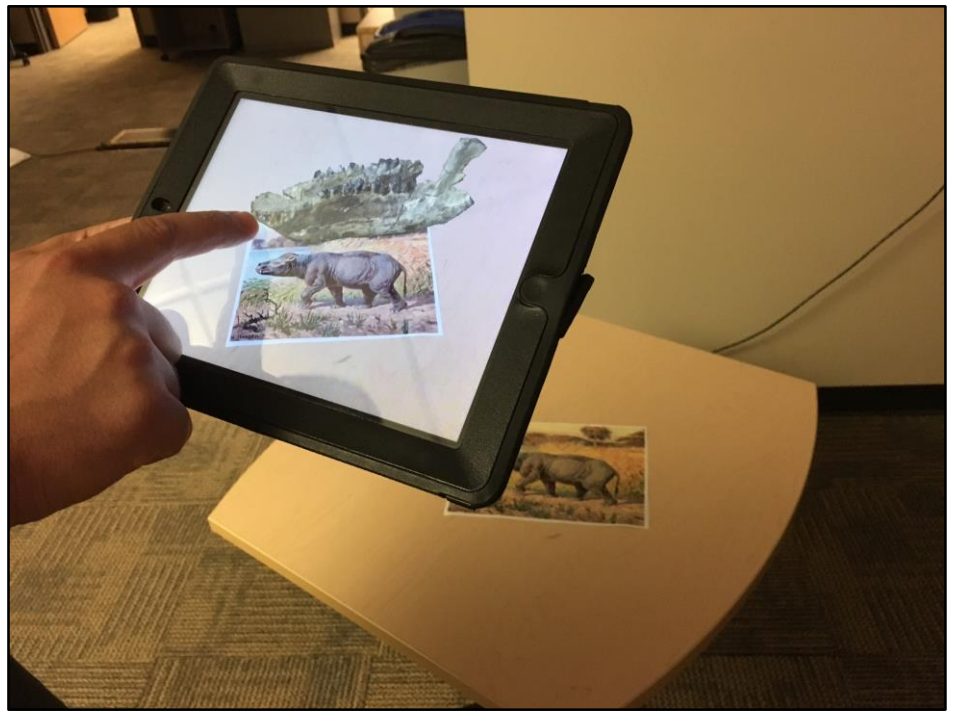
Marker-based AR using mobile devices

- Real-world marker + digital media = augmented reality experience
- Vuforia + Unity
  - Excellent quality, good tracking options (2D images, 3D objects)
  - Software utility library for building experiences; Not a ready-to-use application

Use Case: Paleontology Exhibit

- Initiated by Gary Motz, Research Associate, Center for Biological Research Collections, Paleontology
- Dept. of Geological Sciences open house event highlighting emerging tech and new directions in research & teaching

- Paleontology collection of real artifacts
  - Accurately digitized
  - AR app runs on mobile devices



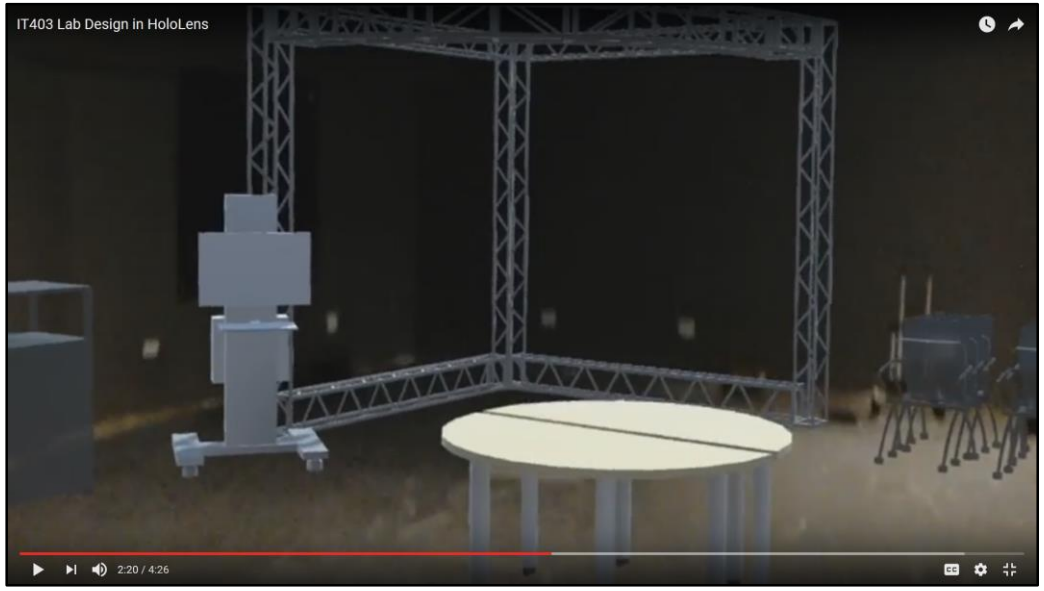
Augmented Reality

Area learning via Microsoft HoloLens

- Basics
  - Combine/overlay 3D computer graphics and the real-world
  - Existing interface for limited data integration
  - Custom programming options using Unity to add your data to your room

- Advanced
  - Incorporate VR trackers to enable augmenting moving real-world objects

Use Case: Using the HoloLens for Space Planning



https://www.youtube.com/watch?v=JhgKvGd8tGU

- Existing IUPUI lab to be refitted with new tech/furniture
  - Create 3D models of potential tech/furniture
  - Place those 3D models in the real space and view using HoloLens
- Enables better decision-making
  - Better sense of scale

Examples: Augmented Reality

- Prostadontics HoloLens Pre-Visualization - https://showcase.avl.iu.edu/avl-showcase/frontend/projects/5a37e2670d965
- Medical device training application - https://showcase.avl.iu.edu/avl-showcase/frontend/projects/5a37ec3940a12

IQ-Table & Interactive Multi-Touch Exhibits & Applications

- IQ-Table v3
  - 65" multi-touch 4K monitor with PCAP touch technology
  - Reasonably portable
  - Included Windows PC
  - Accessible for museums and related venues

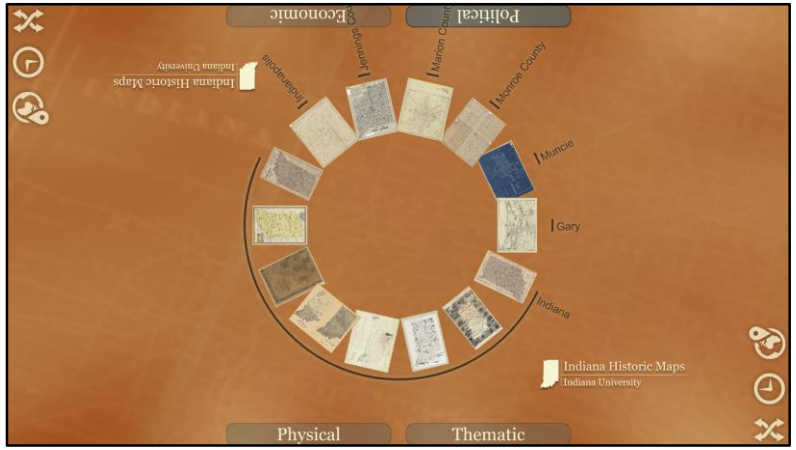
- Web-enabled tools (HTML5, CSS, JavaScript) -> affords rapid dev
  - three.js, AngularJS, Hammer, Node.js, Angulartics, Videogular, Electron, …
- Wide variety of pre-existing libraries and tools -> allows customized apps
- Lots of technical talent in this space -> helps enlist student support and more adopters

- Supported media types
  - Images (including maps & panoramas), videos, audio clips, 3D objects

Use Case: Angel Mounds State Historic Site

- Collaboration with Glenn A. Black Laboratory of Archaeology
- Learn about the Angel Mounds site and Mississippian culture through high-resolution photos, videos, and metadata
- First installation of the IQ-Table v2 featuring 4K resolution
- AVL's first multi-touch application built with web technologies (HTML, CSS, JavaScript)

Use Case: Collection Viewing



- Your media & metadata
- Sorting & filtering operations
- “circular” orientation around the table

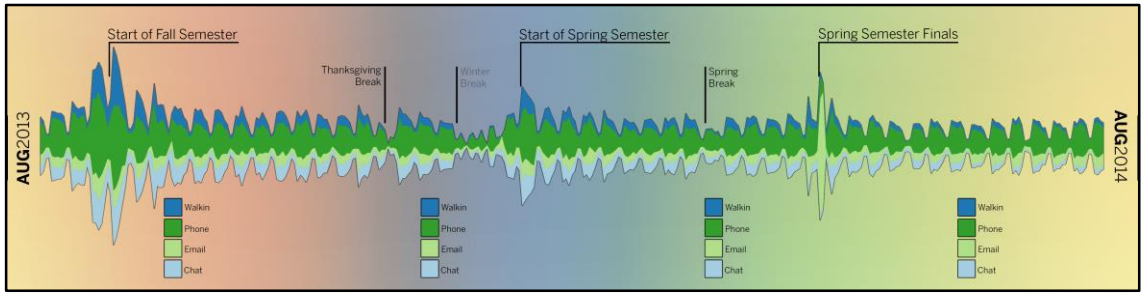
Use Case: Digital Interfaces to Scanned Books

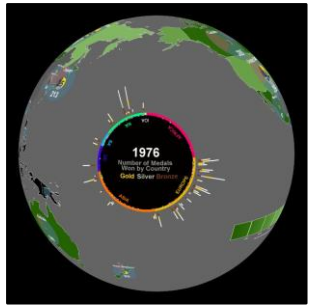
- Digital Scroll
  - Collaboration with the Lilly Library
  - A multi-touch interface to Jack Kerouac's *On the Road* manuscript

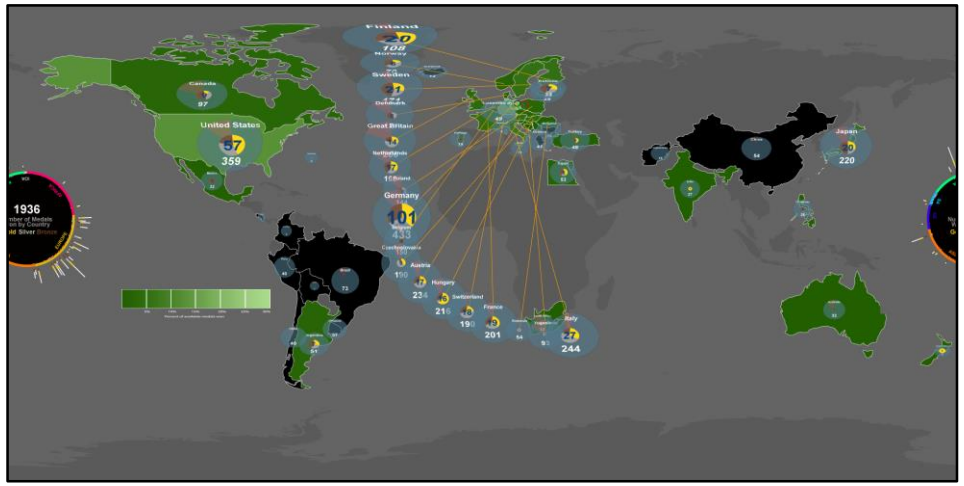
- Digital Golden Book
  - Developed with the IU Office of Veteran Affairs and the Digital Library Program
  - Allows users to interact with the Golden Book, which cannot be done with the physical book.
  - Permanently housed in the Indiana Memorial Union

Information Visualization

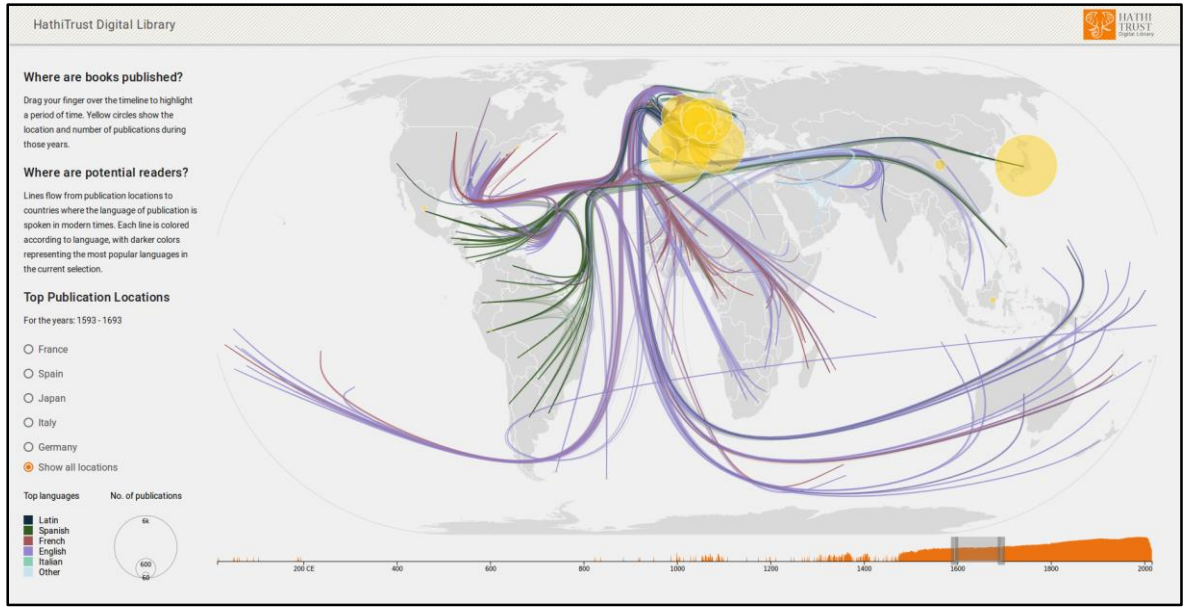
- Planar displays
  - IQ-Table, IQ-Wall, desktop monitor or mobile device
- Spherical displays
  - Science on a Sphere
- Software varies from developer libraries to applications with GUI
  - D3, Crossfilter, chroma.js, Leaflet, Raw, Tableau, Processing, Sci2, Gephi, Cytoscape, …







Use Case: HathiTrust Digital Library Macroscope



- Collaboration with the IU Cyberinfrastructure for Network Science Center and the HathiTrust Research Center
- Part of the Places & Spaces: Mapping Science exhibit, Iteration XII
- When a user selects a time period, the map updates to show circles illustrating the locations and numbers of publications
- Curves flow out to countries where the publications' languages are spoken today

Large-Format, Ultra-Resolution Visualization & Collaboration using IQ-Walls

- Built and installed 15 IQ-Walls of various sizes across 3 IU campuses from 2009 – present
  - Have a proven recipe; We can help you too
- Runs from Windows PC with many off-the-shelf software
  - Broadly applicable with low barrier of entry
- Ultra-resolution
  - Show something very detailed or many things at once
- Large size
  - Conducive to collaboration

IQ-Walls at IU as of 1/19/18

Location	*Primary Purpose*	*Configuration*	*Total Resolution*	*Size*	*Campus*
Mathers Museum of World Culture, 2009	Teaching, Exhibits	3 x 4	4098 x 3072 (12.5 MP)	10' x 8'	IUB
School of Informatics & Computing, 2010	Research	3 x 3	4098 x 2304 (9.5 MP)	10' x 6'	IUB
Cyberinfrastructure Building, 2011	Public Space, Research	6 x 4, curved	10080 x 4200 (42 MP)	24' x 9'	IUB
Global Research Network Operations Center, 2011	Operations	6 x 2	11520 x 2160 (25 MP)	24' x 4.5'	IUB
Social Science Research Commons, 2012	Research, Presentations	2 x 2	1920 x 1080 (2.1 MP, scaled up 2x)	8' x 4.5'	IUB
Wells Library Scholars Commons, 2014	Public Space, Research	4 x 4, 3D	5464 x 3072 (17 MP)	13.5' x 8'	IUB
Indiana University Foundation, 2015	Public Relations	3 x 3	1920 x 1080 (2.1 MP, scaled up 3x)	10' x 6'	IUB
Global & International Studies Building, 2015	Public Space, Presentations	4 x 4	7680 x 4320 (34 MP)	13.5' x 8'	IUB
IUB Data Center, 2015	Operations	8 x 2	15360 x 2160 (34 MP)	27' x 4'	IUB
IUPUI Data Center, 2016	Operations	3 x 2	5760 x 2160 (12.5 MP)	10’ x 4’	IUPUI
Hodge Hall, 2016	Presentations	4 x 2	7680 x 2160 (16.5 MP)	16’ x 5’	IUB
Ruth Lilly Medical Library, 2016	Research, Presentations	4 x 2, touch	7680 x 2160 (16.5 MP)	16’ x 5’	IUPUI
ICTC Room 414, 2016	Research, Presentations	4 x 2, touch	7680 x 2160 (16.5 MP)	16’ x 5’	IUPUI
Whitewater Hall, 2017	Public Space, Presentations	4 x 4	7680 x 4320 (34 MP)	13.5' x 8'	IUE
Luddy Hall, 2017	Research, Presentations	4 x 4, 3D	7680 x 4320 (34 MP)	13.5' x 8'	IUB

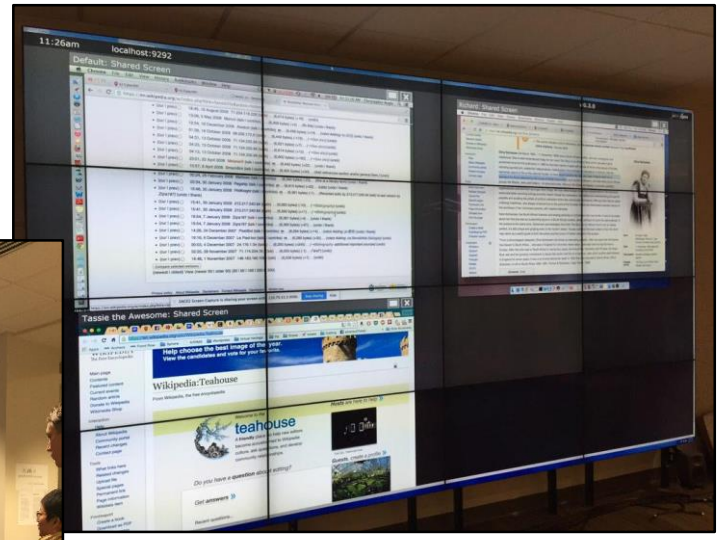
IUB IQ-Walls in Action

Cyberinfrastructure Building

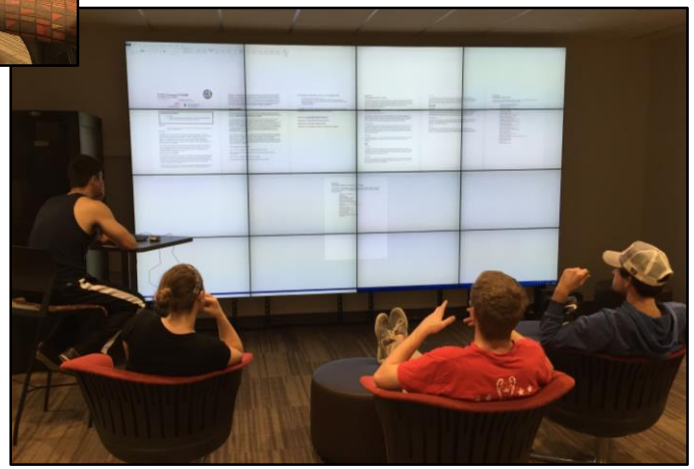
Global Network Operations Center

Global & International Studies Building

Mathers Museum of World Culture



Scholars Commons



Digitizing Real-World Objects & 3D Printing

Technology

- Digitize objects using
  - ***3D scanners***
    Creaform GoScan + VXElements software
  - ***photogrammetry*** techniques
    DSLR or phone camera + Agisoft Photoscan

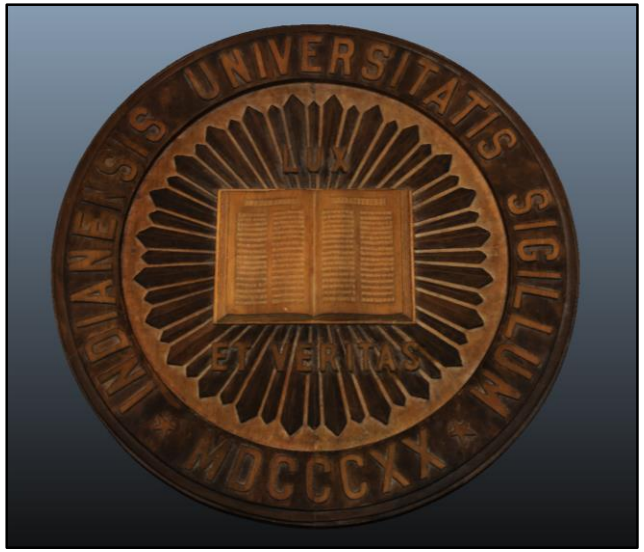
- Process the data (fill holes, fix textures, edit materials, etc.)
  Zbrush or Geomagic Design X software

Uses

- 3D printed
- Virtual or augmented reality environments or video games
- Viewed on web
- Interactive media collections
- Input to 3D modeling package for additional manipulation
- Analysis
- Virtual restoration/reconstruction

Use Case: IUPUI Ruth Lilly Medical Library Collection

- Dozens of available items from IU School of Medicine
  - 10 scanned & processed
  - Plaque: The Seal of Indiana University Light and Truth 1820
  - Gavel: Presented to the Class of 1904



HANCOCK COUNTY MEDICAL SOCIETY
GREENFIELD, INDIANA
Meets Second Wednesday of Each Month

MEMBERS

MEMBERS MARKED (*) ARE HONORARY LIFE MEMBERS, STATE AND COUNTY

PHYSICIANS

GREENFIELD
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R. N. ARNOLD
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D. D. GILL
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DENTISTS

GREENFIELD
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R. I. BELL
D. H. CRIDER
K. C. DAWSON
C. D. MORTON
K. WATTS

FORTVILLE
J. B. DEAKYNE

Presented to the Class of 1904,

Medical College of Indiana by one of its

Members, Dr. Howard Roy Hess of Cedar Rapids, Iowa,

April 22, 1931.

Not long ago I received a piece of wood from a little island in the Adriatic Sea which, in the days before the dawn of Greek civilization was Epidaurus. It was on the moonlit slope of Epidaurus where, according to the oracle. Phoebus Apollo seduced the fair robed nymph, Coronus. From that union of Strength and wisdom with beauty and grace was born the great and the wise and the good Aesculapius. My trusted friend who brought me this wood declares that he has established beyond any shadow of doubt that the tree from which it came is a direct descendent of the one from which the original staff of Aesculapius was hewn and around whose ancestors in ancient times twined the classic Aesculapian serpent. Is it not fitting, Mr. President, that from this wood, should be wrought for this class an emblem of authority? Is it not right and proper that such an emblem should symbolize the ancient code by which we govern our lives and the high and honorable calling which we serve? And so, Mr. President, from this wood, steeped in a rich tradition of endeavor and achievement, I have carved a gavel. It is my honor and pleasure to present this gavel to you, and through you, to the class of 1904.

I pray Apollo and to Hygea, to Panacea, and to Aesculapius the father of us all, that the need may never arise for it to be used to quell dissention in this brotherhood.

It is my wish that when the last meeting of the class shall have been adjourned that this gavel be placed in the archives of the Indiana Medical College, there to remain as a memento of the class of 1904.

Gavel Presented to The Indiana University Medical College Alumni Association May 5, 1948 by The Class of 1904, M.C.I.,
Joseph L. Allen, Hist. Pres.
Class 1904

Use Case: IUPUI Ruth Lilly Medical Library Collection

- More than 20 items donated from Leo J McCarthy (Prof. Emeritas of Pathology, IU SoM)
  - 10 scanned & processed
  - Most pre-date 1800's (oldest from 1679)
  - Acquisition required gloves; some devices/tools with remnants of blood

Examples: 3D Scanning & Printing

- Bleeding bowl - https://showcase.avl.iu.edu/avl-showcase/frontend/projects/5a37f6e71053e
- Old Oaken Bucket - https://showcase.avl.iu.edu/avl-showcase/frontend/projects/5a388f146cc2b

Creating Advanced Media

Technology

- Stereoscopic 3D media production
  - S3D rig + Adobe Premiere Pro
- Spherical 360 capture
  - Rhico Theta & Vuze 4K S3D
- Ultra-resolution image capture
  - Gigapan robot & DSLR camera + Gigapan Stitch or Adobe Photoshop (stitching software)
- Matterport 3D Camera
  - 3D environment scanning

Uses

- Virtual or augmented reality environments or video games
- Web viewing
- Interactive media collections
- Stereoscopic movies or imagery
- Educational experiences & virtual visits (presence enhanced by 360 & S3D)
- Detailed documentation/analysis of sites or events

Use Case: 360 Nature Viewer on Gear VR Mobile Display

- Miyeon Jung, Postdoctoral Fellow from IU School of Nursing
- Immerse elderly patients in virtual nature scenes
  - Park, beach, mountains
- Enhance with calming accompanying audio
- Measure response

Examples: Advanced Media

- Student-captured spherical 360 images – https://showcase.avl.iu.edu/avl-showcase/frontend/projects/5a37eb12c0dd1
- Hoover Dam Gigapan – https://showcase.avl.iu.edu/avl-showcase/frontend/projects/5a37e9eccfb1c
- Matterport scan of IU Make Innovate Learn Lab – https://showcase.avl.iu.edu/avl-showcase/frontend/projects/5a37e0d02a998

Thank You!

Demos & Discussion

- https://showcase.avl.iu.edu/avl-showcase/frontend/projects

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